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(54) Permanent ferrule housing assembly

(57) A permanent assembly has in a housing (12), two mated, tuned ferrules (16, 18) end to end in a sleeve (24), the ferrules are biased against one another by a spring member (30) to ensure contact of the ferrule fac-

es (32, 34). The ferrules (16, 18) are attached to optical fibers (26, 28), one being a single mode and one a multi-mode, and strength members (36, 38) associated with the optical fibers (26, 28) are secured to the assembly. A heat shrink cover (52) is secured over the assembly.

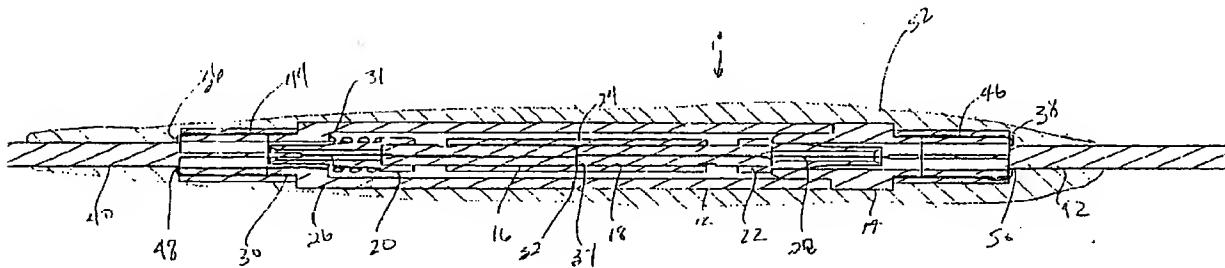


FIG. 1

Description

[0001] The present invention is directed to an assembly that permanently houses two mated, tuned ferrules. Specifically, the assembly houses two ferrules, one attached to a single mode optical fiber and one attached to a multi-mode optical fiber. The ferrules are mated, taking the eccentricities of the ferrules into account, so that the desired amount of light passes from the single mode fiber to the multi-mode fiber. Typically, an assembly containing such a splice between single and multi-mode fibers occurs in a conditioning patch cord and eliminates Differential Mode Delay effects. Heretofore, no permanent assembly has been known that allows for the permanent mating of the tuned ferrules. Prior attempts of permanently mating the ferrules have failed, due to ferrules separating during thermal cycling, or a lack of adequate tensile strength of the mating point. Thus, there is a need for a permanent ferrule assembly housing that achieves these benefits.

[0002] Among the objects of the present invention is to provide a permanent ferrule assembly housing that maintains the integrity of the mating point of the mated ferrules.

[0003] Other objects and advantages of the present invention will become apparent from the following detailed description when viewed in conjunction with the accompanying drawings, which set forth certain embodiments of the invention. The objects and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

[0004] To achieve the objects and in accordance with the purposes of the invention as embodied and broadly described herein, the invention comprises a fiber optic ferrule assembly for permanently housing two mated, tuned ferrules, the ferrules joined end to end in a sleeve, comprising an elongated housing sized to receive the two mated, tuned ferrules and sleeve therein, a ferrule holder attached to each ferrule, and a biasing member engaging a first ferrule holder to bias the two ferrules against one another.

[0005] To achieve the objects and in accordance with the purposes of the invention as embodied and broadly described herein, the invention also comprises a fiber optic ferrule assembly for permanently housing two mated ferrules, the ferrules joined end to end in a sleeve, comprising an elongated housing sized to receive the two mated ferrules and sleeve therein, the housing having a first opening at a first end sized to receive an optical fiber secured to a first ferrule and a second opening at a second end sized to receive the two mated ferrules, an end cap securable to the second end and defining a passageway therethrough for receiving an optical fiber secured to the second ferrule, a ferrule holder attached to each ferrule, and a biasing member interacting with the first ferrule holder and the housing to bias the two ferrules against one another.

[0006] To achieve the objects and in accordance with the purposes of the invention as embodied and broadly described herein, the invention also comprises a method of permanently housing two mated, tuned ferrules in

5 assembly comprising the steps of inserting two ferrules into opposite ends of a sleeve member, each of the ferrules being attached to an optical fiber, orienting the ferrules in the sleeve to achieve a predetermined transmittance of light from one optical fiber to the other, and sliding a first portion of a housing along one of the optical fibers and over at least a portion of the mated ferrules, sliding a second portion of the housing along the other optical fibers to engage the first portion of the housing.

10 [0007] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed.

15 [0008] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Brief Description of the Drawings

20 [0009]

Figure 1 is cross-sectional view of a permanent ferrule housing assembly according to the present invention; and

25 Figure 2 is an exploded view thereof.

[0010] A ferrule assembly 10 according to the present invention preferably has a front portion or housing 12 and a second portion or end cap 14. The assembly 10 houses two ferrules 16,18, each ferrule being secured within its own ferrule holder 20,22. The ferrules are inserted into a sleeve 24 to keep the optical fibers 26,28 secured in the ferrules 16,18 aligned. A spring 30, mounted over one of the ferrule holders 20 biases the ferrules against the end cap 14 using a shoulder 31 on the inside of housing 12 and keeps the faces 32,34 of the ferrules in contact. The housing 12 and end cap 14 are preferably cylindrical in shape and have an inner diameter that is slightly larger than the ferrule holders and sleeve, but could also be other shapes, such as rectangular (preferable if used for multi-fiber connections), so long as the contained components have sufficient clearance. Additionally, while one of the portions of the assembly 10 is shown to be much longer than the other, the housing 12 and end cap 14 may be of any relative length, including the same length.

[0011] To add to the integrity of the assembly, the strength members 36,38 from each of the fiber optic cables 40,42 are secured to each end 48,50 of the assembly 10 by crimp bands 44,46. After the end cap 14 is secured to housing 12 with the ferrules 16,18 in place, the strength members 36,38 are secured to the end por-

tions 48,50 of the assembly 10 by crimp bands 44,46, respectively. The end portions 48,50 have a reduced outer diameter relative to the housing 12 and the end cap 14.

[0012] The method for assembling assembly 10 will now be described with reference to Fig. 2. A first fiber optic cable 40 has a first crimp band 44, housing 12, and spring 30 placed over the end of the optical cable to be joined in the assembly 10. Fiber optic cable 40 could have either a single or multi-mode optical fiber therein. The optical fiber 26 has already been or will then be exposed from cable 40 as is known in the art. A ferrule holder 20 and ferrule 16 are secured on the end of the optical fiber 26 as is also known in the art. The same procedure occurs for a second fiber optic cable 42 with crimp band 46 and end cap 14. The optical fiber cable 42 has the opposite type of optical fiber from optical fiber cable 40. Thus, if the optical fiber 26 in cable 40 is a single mode fiber, then the optical fiber 28 in cable 42 would be a multi-mode fiber, and vice versa. Ferrule holder 22 and ferrule 18 are then secured on the optical fiber 28.

[0013] The ferrules can then be mated in sleeve 24 in one of two different ways. In the first method, the ferrules 16,18 are inserted into the sleeve 24 and the multi-mode fiber is attached to a light source. (Once installed, the light path is typically from the single mode fiber to the multi-mode fiber. However, the light path is the opposite during the tuning.) The light passing out of the single mode fiber on the other side of the mated ferrules is measured, and the ferrules are tuned (turned relative to one another) based upon the passage of light, or the power ratio measurement. By turning the ferrules relative to one another, a specific relationship of the eccentricities (and therefore the offset of the centers of the optical fibers) of the ferrules can be achieved, thereby allowing a specified amount of light to pass from the single mode fiber to the multi-mode fiber in the conditioning patch cord.

[0014] In the second method, the eccentricities of the ferrules are determined. Once the eccentricities are determined, a mark is made on the ferrule or ferrule holder. For example, a mark may be made directly on the ferrule, or the ferrule may be mounted into a ferrule holder having a key that indicates the direction of the ferrule's eccentricity. Therefore, when the ferrules are inserted into the sleeve and the markers are aligned in a specific orientation, the ferrules can be properly aligned without the need to measure the light transmission through the fibers.

[0015] The fit between the end cap 14 and the housing 12 is very tight, so the end cap 14 is preferably inserted into the housing 12 using a pneumatic press, although an appropriate hand press could also be used. The tight fit of the end cap 14 into the housing 12 adds to the strength and performance of the assembly 10. To further increase the strength and performance of the assembly 10, epoxy or some other bonding substance can be used in the seal between the end cap 14 and housing

12. Alternatively, the end cap 14 and housing 12 could be so configured that one part screws into the other, rather than the press fit of the embodiment shown. Other variations that are not shown are also possible. For example, the end cap could have flexible tabs that engage holes or depressions in the housing. The cap and housing be configured to allow a ring or pin to be inserted through the cap and housing to hold the assembly together.

5 10 [0016] The strength members 36,38 of the fiber optic cables are then secured to the assembly 10 as described above with crimp bands 44,46. Finally, a heat shrink cover 52 with an adhesive coating on its inside surface is then placed and secured over the assembly 15 10. An alternative to securing the strength members 36,38 with the crimp bands 44,46, is to insert the strength members 36,38 between the housing 12 and the heat shrink cover 52. The strength members 36,38 would then be secured to the assembly 10 when the 20 heat shrink cover 52 is secured.

[0017] It should be noted that idea of a permanent assembly as used herein means that the mating of the two fibers and ferrules is not designed to be changed. Obviously, the assembly could be opened and the ferrules 25 remated, but one would have to most likely destroy the assembly to do so. There are other well-known connections of optical fibers that are intended to be connected and reconnected any number of times. However, those types of connections are not intended to be included or 30 incorporated by this assembly.

Claims

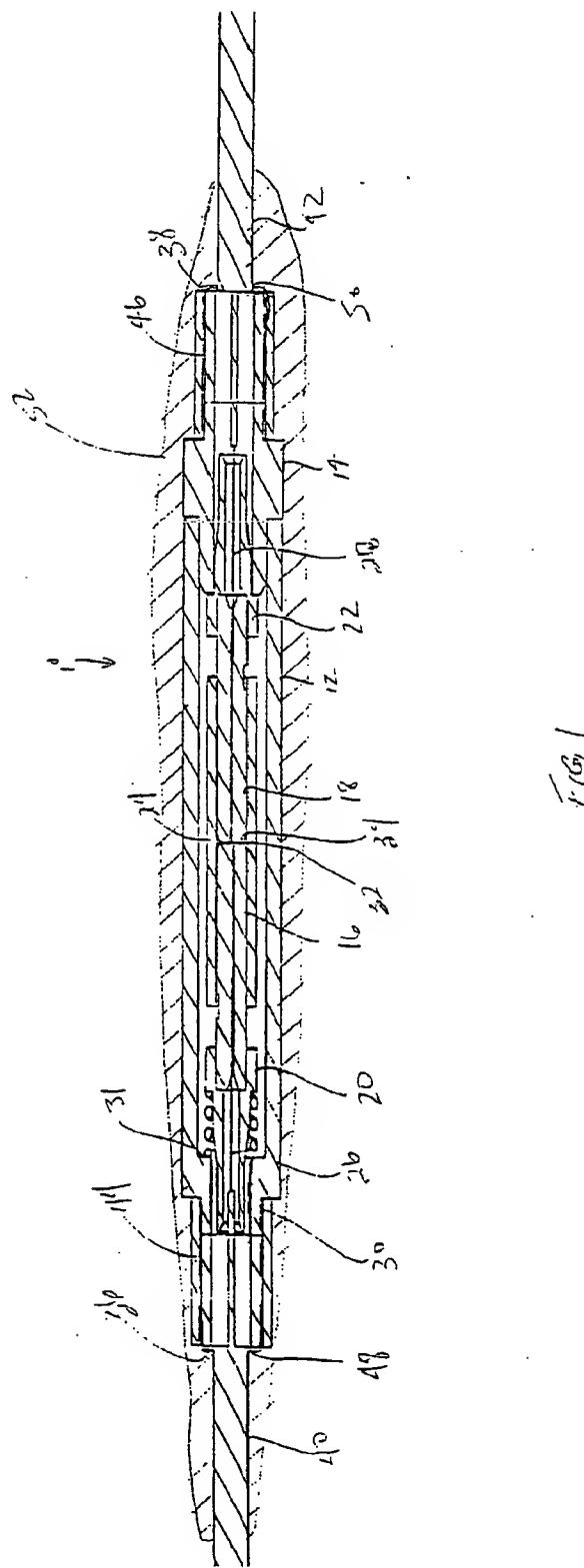
35 1. A fiber optic ferrule assembly for permanently housing two mated, tuned ferrules, the ferrules joined end to end in a sleeve, comprising:
40 an elongated housing sized to receive the two mated, tuned ferrules and sleeve therein; a ferrule holder attached to each ferrule; and a biasing member engaging a first ferrule holder to bias the two ferrules against one another.

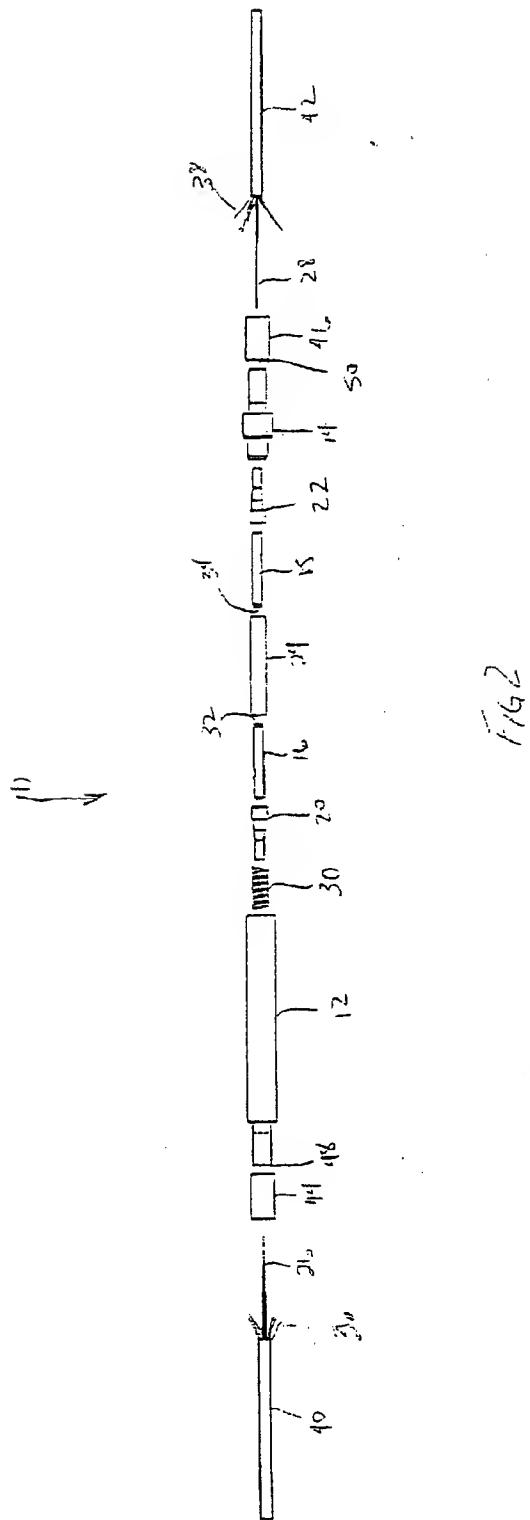
45 2. The fiber optic ferrule assembly of claim 1, wherein the elongated housing comprises:
50 a first portion having a first opening at a first end sized to receive a first optical fiber and a second opening at a second end sized to receive the two mated ferrules; and a second portion securable to the second end of the first portion and defining a passageway therethrough for receiving a second optical fiber.

55 3. The fiber optic ferrule assembly of claim 2, wherein the second portion is an end cap, and the end cap

and the first end of the first portion each have a crimp band to secure strength members associated with the optical fibers to the assembly.

4. The fiber optic ferrule assembly of claim 3, wherein the end cap is configured to be press fit into the second end. 5
5. The fiber optic ferrule assembly of claim 3, wherein the end cap is configured to be screwed into the second end. 10
6. The fiber optic ferrule assembly of claim 3, wherein the end cap is secured to the cylindrical housing with epoxy. 15
7. The fiber optic ferrule assembly of claim 3, wherein the end cap is configured to be snapped into the second end. 20
8. The fiber optic ferrule assembly of any one of Claims 1-7, further comprising a shrinkable member disposed around the housing.
9. The fiber optic ferrule assembly of any one of Claims 1-8, wherein the biasing member comprises a spring. 25
10. The fiber optic ferrule assembly of Claim 2 or any one of Claims 3-9 as appended thereto, wherein the first optical fiber is one of a single-mode or multi-mode optical fiber, and the second optical fiber is the other optical fiber. 30
11. The fiber optic ferrule assembly of any one of Claims 1-10, wherein the elongated housing comprises:
 - a first portion having a first opening at a first end sized to receive a first optical fiber and a second opening at a second end sized to receive at least a portion of one of the two mated ferrules; and 40
 - a second portion having a first opening at a first end sized to receive a second optical fiber and a second opening at a second end, the second opening of the second portion securable to the second end of the first portion and sized to receive at least a portion of one of the ferrules. 45
 - wherein the first portion and the second portion are of about equal lengths. 50







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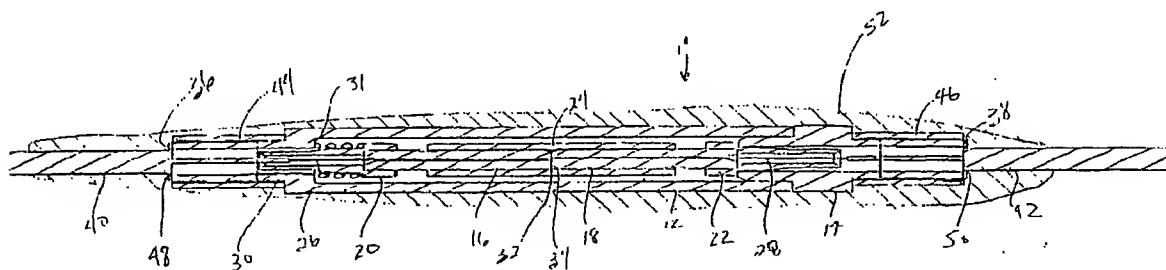
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4/67 1



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EUROPEAN SEARCH REPORT

Application Number
EP 99 31 0228

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US 4 597 632 A (MALLINSON STEPHEN R) 1 July 1986 (1986-07-01) * column 4, line 43-48 * * column 6, line 1 - line 42 * * figures 1,2 *	1,2,5,9	G02B6/38
Y	---	3,4,6-8, 10 11	
A			
Y	US 5 321 784 A (CUBUKCIYAN NURAN H ET AL) 14 June 1994 (1994-06-14) * column 7, line 8 - line 10 *	3	
Y	US 5 123 071 A (SCHAFFER RONALD R ET AL) 16 June 1992 (1992-06-16) * column 5, line 54 - line 56 * * column 6, line 2 - line 5 * * column 3, line 7 - line 9 *	4,6,7	
Y	EP 0 744 806 A (AT & T CORP) 27 November 1996 (1996-11-27) * column 5, line 38 - line 60 *	8	TECHNICAL FIELDS SEARCHED (Int.Cl.)
Y	PATENT ABSTRACTS OF JAPAN Vol. 014, no. 269 (P-1059), 11 June 1990 (1990-06-11) & JP 02 077703 A (FUJITSU LTD), 16 March 1990 (1990-03-16) * abstract *	10	G02B
A	US 5 838 857 A (NIEKRASZ EDWARD J) 17 November 1998 (1998-11-17) * figure 4A * * figure 9 * * column 11, line 1 - column 12, line 5 *	1-3,5,11	
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
MUNICH	3 May 2002	Anderson, C	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 99 31 0228

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-05-2002

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 4597632	A	01-07-1986	AT CA DE EP JP	40011 T 1251967 A1 3378930 D1 0112072 A2 59139579 A	15-01-1989 04-04-1989 16-02-1989 27-06-1984 10-08-1984
US 5321784	A	14-06-1994	AU AU BR CA CN CZ CZ EP HU JP PL RU TR WO	680878 B2 6163294 A 9405729 A 2156283 A1 1118191 A ,B 9601251 A3 9502093 A3 0685080 A1 73104 A2 8506910 T 310352 A1 2134895 C1 27640 A 9419717 A1	14-08-1997 14-09-1994 28-11-1995 01-09-1994 06-03-1996 11-09-1996 17-07-1996 06-12-1995 28-06-1996 23-07-1996 11-12-1995 20-08-1999 14-06-1995 01-09-1994
US 5123071	A	16-06-1992	DE FR GB US	9102805 U1 2659455 A1 2241794 A 5082344 A	29-05-1991 13-09-1991 11-09-1991 21-01-1992
EP 0744806	A	27-11-1996	US AU AU CA DE DE EP JP	5661842 A 699143 B2 5244396 A 2174269 A1 69614194 D1 69614194 T2 0744806 A1 8327846 A	26-08-1997 26-11-1998 05-12-1996 27-11-1996 06-09-2001 21-03-2002 27-11-1996 13-12-1996
JP 02077703	A	16-03-1990	NONE		
US 5838857	A	17-11-1998	AU EP WO	8311298 A 0974174 A1 9845899 A1	30-10-1998 26-01-2000 15-10-1998

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